Communicating the Benefits of SAFER

Abstract

The Risk-Based Explosives Safety Criteria Team (RBESCT) was established by the DoD Explosives Safety Board (DDESB) in 1997 to develop risk-based models for explosives safety management and recommend risk-based explosives safety criteria. Safety Assessment for Explosives Risk (SAFER) 3.1 is the latest version of the risk-based software for siting DoD facilities. This paper briefly describes the development history of SAFER, SAFER documentation, the applications of SAFER for siting facilities in explosives areas, and the benefits derived from using SAFER for siting facilities. Approaches for communicating the application and the benefits of SAFER are also discussed.

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14. ABSTRACT
The Risk-Based Explosives Safety Criteria Team (RBESCT) was established by the DoD Explosives Safety Board (DDESB) in 1997 to develop risk-based models for explosives safety management and recommend risk-based explosives safety criteria. Safety Assessment for Explosives Risk (SAFER) 3.1 is the latest version of the risk-based software for siting DoD facilities. This paper briefly describes the development history of SAFER, SAFER documentation, the applications of SAFER for siting facilities in explosives areas, and the benefits derived from using SAFER for siting facilities. Approaches for communicating the application and the benefits of SAFER are also discussed.

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1.0 DEVELOPMENT HISTORY OF SAFER

For more than 100 years, Quantity-Distance (QD) criteria have been used in making explosives safety judgments. For the last 30 years, it has been recognized that QD, which generally considers only the explosives quantity, hazard classification, and facility type to determine a safe separation distance, could be improved upon by including other considerations to assess the overall explosives risks of the operation. These considerations include the type of explosives activity being conducted, the number of people exposed and their exposure time, the relationship of exposed personnel to the explosives activity being conducted, potential explosion site (PES) and exposed site (ES) building construction, and environment. With those considerations and others in mind, the DoD Explosives Safety Board (DDESB) has coordinated the development of risk-based methods and the computer model, Safety Assessment for Explosives Risk (SAFER), to determine the risks associated with explosives locations and operations.

SAFER was developed to determine the probability of fatality to an individual and the expected fatalities from an explosives accident. SAFER Version 1.0 was delivered to the Risk-Based Explosives Safety Criteria Team (RBESCT) in May 2000, and since that time several follow-on versions have been developed. The latest version, SAFER Version 3.1 was approved for release in August 2009.

2.0 SAFER DOCUMENTATION

The underlying logic and instructions on how to use SAFER are documented in DDESB Technical Papers (TPs) and technical memoranda. These documents are described below. All of the documents described are available on the DDESB website (http://www.ddesb.pentagon.mil under technical papers).

2.1 DDESB TECHNICAL PAPER 14

Technical Paper (TP) 14 provides the DDESB approved methodologies for calculating the risk associated with explosives operations and storage (Ref. 1). The three elements of the risk methodology are described (i.e., the probability of event, probability of fatality given an event, and exposed personnel). The purpose of this document is to record the underlying logic and algorithms used in the SAFER Version 3.1 tool.

2.2 DDESB TECHNICAL PAPER 19

TP 19 is the user's guide for the SAFER software (Ref. 2) Version 3.1. TP 19 describes the SAFER installation procedures, product startup, User Interface, PES/ES tree, User Settings Window, Output Results Window, command buttons, field names, and menu options.

2.3 TECHNICAL MEMOS

The technical memos address the major technical and analytical decisions made as part of the architecture development. The technical memos address areas concerning the SAFER Close-in Fatality Mechanism (SCIFM), input selection, the

thermal and pressure and impulse branch in addition to others. There are a total of fourteen technical memos included as attachments to TP 14.

3.0 THE APPLICATIONS OF SAFER FOR SITING FACILITIES IN EXPLOSIVES AREAS

The SAFER tool can be used for risk-based siting, risk management, and for comparison to QD standards. These various applications of the tool are described below.

3.1 RISK-BASED SITING

QD criteria have been used as the primary means for the safe siting of military explosives facilities for more than 80 years. QD criteria consider only the explosives quantity, Hazard Division (HD), and facility type to determine a safe separation distance. SAFER considers many other factors including the type of activity, number of people, building construction, and environment to assess the overall risk of an operation. Additionally, SAFER provides quantitative risk results. The SAFER tool was developed because the DDESB recognized the benefits, and the need, for a risk-based approach for explosives safety. SAFER allows a user to perform risk-based site plans for situations that do not meet QD criteria. If the risks are determined to be acceptable (i.e., below the DDESB risk acceptance criteria), a risk-based site plan may be approved by the DDESB. *DoD 6055.09-STD* Chapter 17 provides guidance on preparing and submitting a risk-based site plan (Ref. 3).

3.2 RISK MANAGEMENT

SAFER can also be used as a risk management tool. SAFER allows the user to enter a scenario into the software and then alter those inputs to see how the risk is affected. Using SAFER to mitigate various factors is a very important feature of the software tool. The tool can assist in planning the location of a new building, the type of construction, and evaluating the risks associated with highly populated buildings that may be right outside the QD arc.

3.3 COMPARISON TO QUANTITY DISTANCE STANDARDS

Another application of SAFER is to assess the quantitative risk for scenarios that meet current QD Standards. The RBESCT has made efforts to compare a set of "hypothetical" cases that would meet QD criteria and analyze those situations with SAFER to determine the quantitative risk. A total of 5,728 "hypothetical" cases were compared. The data for the "hypothetical" cases were entered into SAFER 3.1 and determined to be acceptable or not acceptable by comparing the quantitative risk results to the DDESB criterion for unrelated individuals. The study showed that 14.07% of the cases that were considered acceptable by QD criteria would not be considered acceptable using quantitative risk criterion for unrelated/public individuals. The distribution of results is shown in Figure 1 below.

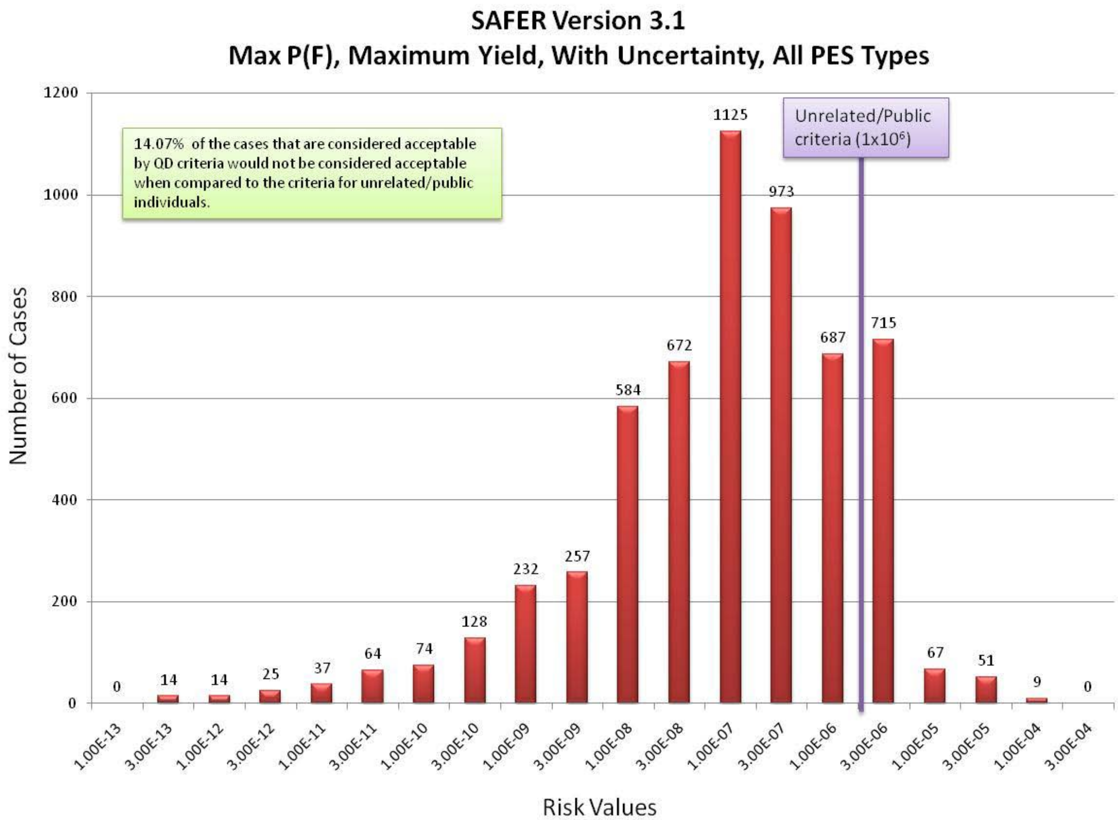

Figure 1. **Distributions of the Quantitative Risk Using SAFER V3.1**

4.0 EXAMPLES OF BENEFITS DERIVED FROM USING SAFER FOR SITING FACILITIES

4.1 MARINE CORPS - BLOUNT ISLAND COMMAND

The Blount Island Command (BIC) Risk Assessment was initiated to determine the risks to people on Blount Island, Jacksonville, FL while port operations are being performed, specifically the loading or unloading of the Maritime Prepositioning Force (MPF) ships. On 19 June 2002, a risk-based site plan was approved for the explosives handling operations at Blount Island by the DDESB. The approved analysis was conducted using SAFER Version 1.0. This analysis used SAFER instead of the traditional QD approach to calculate acceptable risk to unrelated personnel during munitions operations. SAFER was also used as a planning tool to show where facilities could be relocated to reduce risk from BIC munitions and their related operations, and to show how and where unrelated non-munitions commercial operations could be performed while reducing risk from munitions and their related operations. In addition to being determined acceptable, the analysis also eliminated the need for a U.S. Navy Secretarial Certification.

4.2 BENEFITS DEFINED BY THE NAVY

In situations where a risk-based site plan is approved, SAFER has assisted the Navy in reducing the number of waivers or exemptions held. In cases where a

risk-based site plan cannot be obtained, the information provided by SAFER proved to be invaluable to the decision makers in making decisions to accept the risk for the waiver or exemption, or not. Personnel granting or canceling a waiver or exemption for a site plan that does not meet explosives safety QD criteria or risk-based siting criteria has a better understanding of the actual risk involved.

5.0 APPROACHES FOR COMMUNICATING THE APPLICATION AND THE BENEFITS OF SAFER

Performing risk-based siting can be a complex process. Adding a single PES or ES to an area with multiple PESs and ESs can cause a ripple effect on the overall risk profile. Whereas with traditional QD siting the new PES or ES can be looked at in isolation, with risk-based siting the effect of the new PES or ES on the overall situation must be determined. As with any technical material it is important to educate audiences of various backgrounds on the applications and the benefits of using the risk-based approach and the SAFER software. The RBESCT recognizes the importance of this task and is making significant efforts to accomplish this goal. In additional to TP14 and TP19 described in Section 2, a training class on the software is also available to government personnel and their contractors. Some of the topics discussed during training include:

- A background on the concepts and terminology used in the SAFER risk assessment software.
- How to install the SAFER software.
- A thorough guide on using input screens and choosing the proper input selection.
- A description of the capabilities of SAFER including menu options, functions of the tool bar, help menu and generating reports.
- An overview of the 26-step process used by SAFER to familiarize the user with the exposure and consequence analyses.
- Multiple examples (some worked individually and some as a group) demonstrating the various capabilities of SAFER.

Other efforts being developed to aide in communicating the application of SAFER include a Step-by-Step guide, a Workbook containing SAFER problems and solutions, and a Frequently Asked Questions (FAQs) document. The Step-by-Step guide will educate the users on how SAFER can be utilized to complete a risk-based site plan, providing guidance on where to start, how to enter the scenario into SAFER, determining the risk, and comparing the results to the risk acceptance criteria. In addition, the RBESCT is developing an information video to familiarize the DoD explosives safety community with the SAFER risk-based approach to siting facilities in explosives areas.

To date, 60+ papers describing the SAFER tool, risk-based model, science, uncertainty, and supporting test programs have been presented at DDESB

Explosives Safety Seminars, Australian explosives safety seminars (PARARI), International Society of Explosives Engineers (ISEE) conferences, the International System Safety Conference (ISSC) / Joint Weapons System Safety Conference (JWSSC), and the International Symposium on Interaction of the Effects of Munitions with Structures (ISIEMS) conferences.[1] In fact, the following papers that address the development of models and the analysis of test data to support the improvement of risk-based models and software are being presented at this Seminar:

- ISO-3: Program Description and Test Results (Ref. 7)
- SciPan 4: Program Description and Test Results (Ref. 8)
- SPIDER 2 Tests – Response of Typical Wall Panels to Debris and Fragment Impact (Ref. 9)
- Project ESKIMORE – An Update with Emphasis on a Proposed ECM Testing Program (Ref. 10)
- The Future of SAFER Science and Integration of SAFER with ESS (Ref. 11)
- Continued Study of the SAFER/SciPan Mass Bin Concept (Ref. 12)
- ISO Container Source Function Development for the Klotz Group Engineering Tool (Ref. 13)

The DDESB is developing a DDESB webpage for the DDESB website (http://www.ddesb.pentagon.mil) to provide the explosives safety community with background information on the RBESCT, the DDESB risk-based approach for siting, and the technical bases for SAFER.

6.0 SAFER VERSION 3.1 MODEL OVERVIEW

A diagram of the SAFER software architecture is shown in Figure 2. The architecture and revisions made that resulted in SAFER Version 3.1 is more fully described in Ref. 4.

[1] For a complete listing of RBESCT-related papers, see Attachment 11 - RBESCT Bibliography of TP 14 (Ref.1).

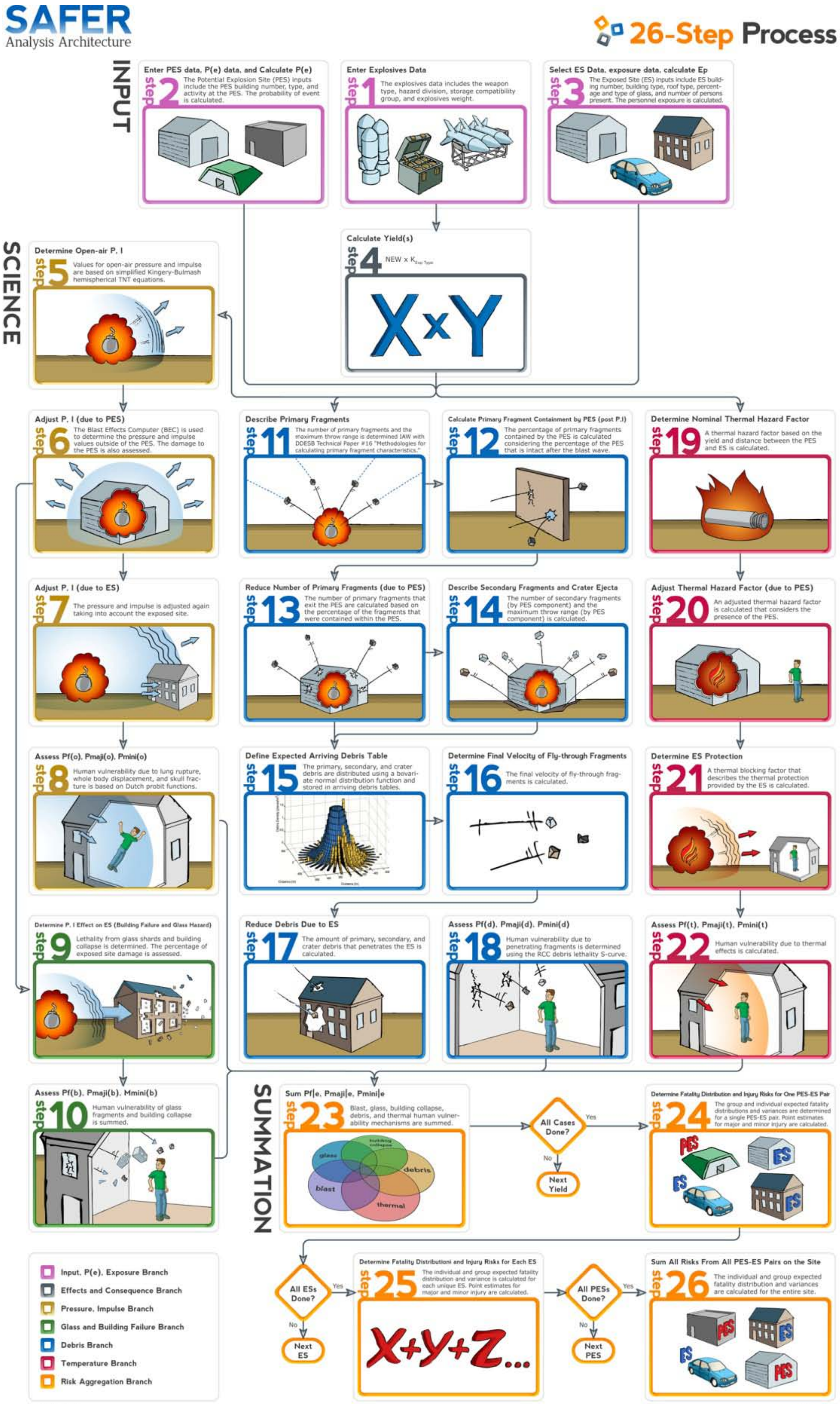

Figure 2. **SAFER Architecture**

The 26 steps in the architecture are divided into six functional groups:

Group 1	Steps 1-4	*Situation Definition, Event and Exposure Analyses* Includes user inputs that describe the situation (PES and ES) and calculates P_e, exposure, and yield
Group 2	Steps 5-8	*Pressure and Impulse Branch* Calculates the magnitude of the fatality mechanisms of pressure and impulse
Group 3	Steps 9-10	*Structural Response Branch* Calculates the magnitude of the fatality mechanisms of building collapse and broken windows (overall building damage)
Group 4	Steps 11-18	*Debris Branch* Calculates the magnitude of the fatality mechanisms for multiple types of flying debris
Group 5	Steps 19-22	*Thermal Branch* Calculates the magnitude of the fatality mechanism heat for HD 1.3 scenarios only
Group 6	Steps 23-26	*Aggregation and Summation* Aggregates the total magnitude and risks of all fatality mechanisms, calculates the desired measures of risk, and assesses overall uncertainty

A detailed description of the approved methods and algorithms developed for DoD risk-based explosives safety siting is documented in DDESB Technical Paper (TP14).

7.0 SAFER 3.1 SUMMARY OF CHANGES

The major modifications between SAFER Version 3.1 and previous versions include:

Graphical User Interface (GUI)/Integration Changes:

- Enhanced computation robustness for very small exposures.
- Increased the impact of the exposure input on risk estimates by revising the confidence values associated with “somewhat confident” and “uncertain” exposures.
- Increased the NEWQD allowed for ships from 5M lbs to 15M lbs.
- Revised the roof and walls names and defaults associated with each ES type.
- Numerous modifications and additions to the validation flags.

Science Algorithm Changes:

- Updated the probability of event matrix to include an additional five years of accident data.
- Developed simplified “close-in” fatality algorithms for each fatality mechanism.

- Included algorithms for determining major and minor injuries.
- Improved debris algorithms (high-angle and low-angle split, and low-angle fragments passing through distances less than maximum debris throw distance).
- Improved crater ejecta algorithm for large NEW cases.
- Improved concrete roof Pressure/Impulse (P-I) diagrams and roof damage determination.
- Created scaled range dependencies on major injury to fatality ratios for glass algorithms.
- Included exposed site (ES) barricades.
- Included ISO container as PES option.
- Included calculation of risk to workers inside the PES.
- Revised uncertainty model.
- Modified the method of splitting the primary fragments into high-angle, fly-through, and side-impact fragments.
- Incorporated new kinetic energy values for some roof types.
- Updated TNT conversion factors for some weapon types.

8.0 SAFER VERSION 3.1 ACCEPTANCE CRITERIA

The RBESCT has developed risk acceptance criteria in conjunction with the methodology development. The DDESB has approved the use of the SAFER model and the risk acceptance criteria. Additionally provisions for using the model and criteria have been approved for incorporation into the next version of *DoD 6055.09-STD* (Change 2), (Ref. 3), which may be downloaded from the DDESB webpage: http://www.ddesb.pentagon.mil/.

Acceptance Criteria

Risk to:	Criteria
Any 1 person (Annual P_f)	Limit maximum risk to 1×10^{-6}
Any 1 related (Annual P_f)	Limit maximum risk to 1×10^{-4}
All public (Annual E_f)	Limit maximum risk to 1×10^{-5}
All related (Annual E_f)	Limit maximum risk to 1×10^{-3}

Figure 3. DDESB Acceptance Criteria

Each measure focuses protection on a different set of persons or conditions. By using a combination of these four measures, the decision maker has a broader understanding of the risks. These measures are applied to three categories of

personnel: those whose jobs relate to the potential explosion site (related), persons who are exposed by virtue of employment (non-related), and all others not included in the previous definitions (public). In determining the criteria the RBESCT developed the Universal Risk Scale (URS) in which data was gathered relating to acceptable risk from a variety of sources. A paper on this work entitled "Criteria Selection for Risk-Based Explosives Safety Standards" was presented at PARARI in 1999 (Ref. 5).

9.0 A Look Ahead to Future Versions of SAFER

When enhancing SAFER in future versions there are many tasks that remain to be done. Below is a list of the priorities for future versions.

- Re-visit group risk
- Re-visit uncertainty
- Re-visit public traffic route (moving/stationary vehicle exposed sites)
- Continue DDESB Science Panel support
    - PES barricades
    - Improve ISO container modeling (Ref. 7)
    - Improve ES response models
    - Improve debris modeling (Refs. 8, 9)
    - SAFER 3.1 flags
- Develop additional assessments
    - Major and minor injuries
    - Building damage (ESs) (Ref. 8)
    - Method to evaluate transients (people in the open)
    - "Other assets" (other exposures that QD protects)
- Integrate SAFER with automated site planning software (Ref. 11)

10.0 Summary

The DDESB and Services have been supporting the development and implementation of the risk-based method since 1997. *DoD 6055.09-STD, change 2*, dated 19 August 2009 includes changes to allow the use of risk-based siting. The RBESCT is developing methods to communicate the use and benefits of the SAFER tool and risk-based method. The RBESCT is continuing to define and make improvements to the SAFER tool and model.

REFERENCES

1. DDESB TP 14 (Revision 4), “Approved Methods and Algorithms for DoD Risk-Based Explosives Siting”, dated 21 July 2009.
2. DDESB TP 19 (Revision 1) “, User’s Reference Manual for the Safety Assessment for Explosives Risk Software”, dated 21 July 2009.
3. DoD 6055.09-STD (Change 2), “DoD Ammunition and Explosives Safety Standards”, dated 21 August 2009.
4. Ward, Jerry and Hardwick, M., “Overview of the SAFER Tool” presented at PARARI 2009, Adelaide, Australia, November 2009.
5. Ward, Jerry, et.al, “Criteria Selection for Risk-Based Explosives Safety Standards” presented at PARARI 1999, Canberra, Australia, October 1999.
6. Ward, J. and Hardwick, M., “Development of a Risk-Based Model and Criteria for Explosives Safety,” presented at ISSC 2009, Huntsville, Alabama, August 2009.
7. Davis, J., et.al, “ISO-3: Program Description and Test Results,” presented at the DoD Explosives Safety Seminar, Portland, Oregon, July 2010.
8. Conway, Robert, et.al, “SciPan 4: Program Description and Test Results,” presented at the DoD Explosives Safety Seminar, Portland, Oregon, July 2010.
9. Crull, Michelle, et.al, “SPIDER 2 Tests – Response of Typical Wall Panels to Debris and Fragment Impact,” presented at the DoD Explosives Safety Seminar, Portland, Oregon, July 2010.
10. Cotton, Lea Ann., et.al, “Project ESKIMORE – An Update with Emphasis on a Proposed ECM Testing Program,” presented at the DoD Explosives Safety Seminar, Portland, Oregon, July 2010.
11. Conway, Robert, “The Future of SAFER Science and Integration of SAFER with ESS,” presented at the DoD Explosives Safety Seminar, Portland, Oregon, July 2010.
12. Tatom, John, et.al, “Continued Study of the SAFER/SciPan Mass Bin Concept,” presented at the DoD Explosives Safety Seminar, Portland, Oregon, July 2010.
13. Tatom, John and Conway, Robert, ““ISO Container Source Function Development for the Klotz Group Engineering Tool,” presented at the DoD Explosives Safety Seminar, Portland, Oregon, July 2010.

Department of Defense
Explosives Safety Board (DDESB)

Communicating the Benefits of SAFER

Presented by
Dr. Jerry M. Ward
DDESB, Director, Policy Development Division
July 14, 2010

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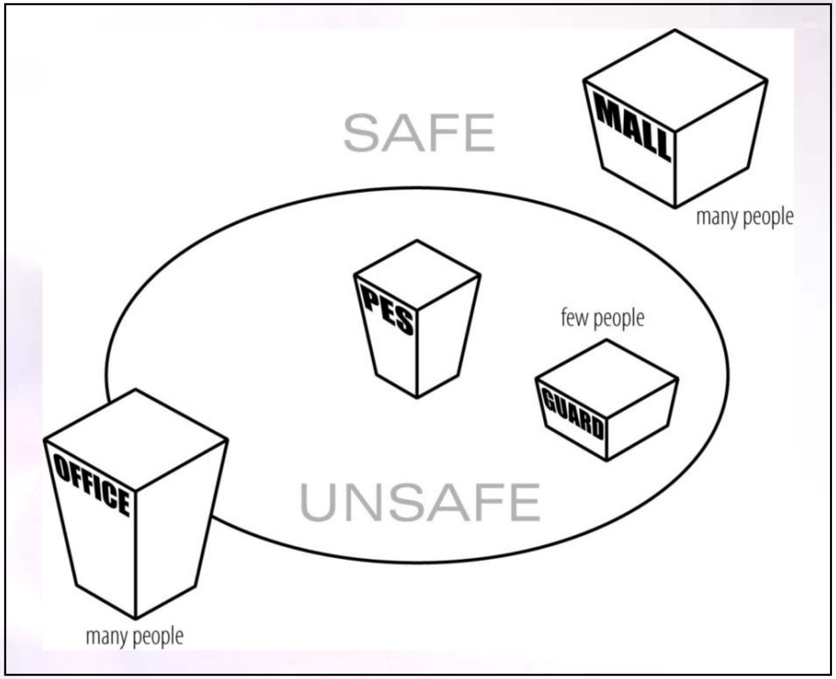
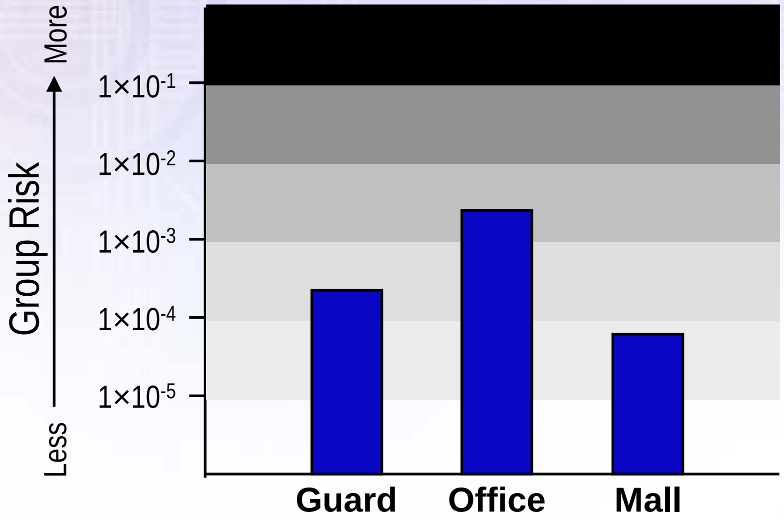
What are Risk-Based Decisions?

Quantity-Distance



- Historical basis
- Less debate ~ arbitrary
- Good record

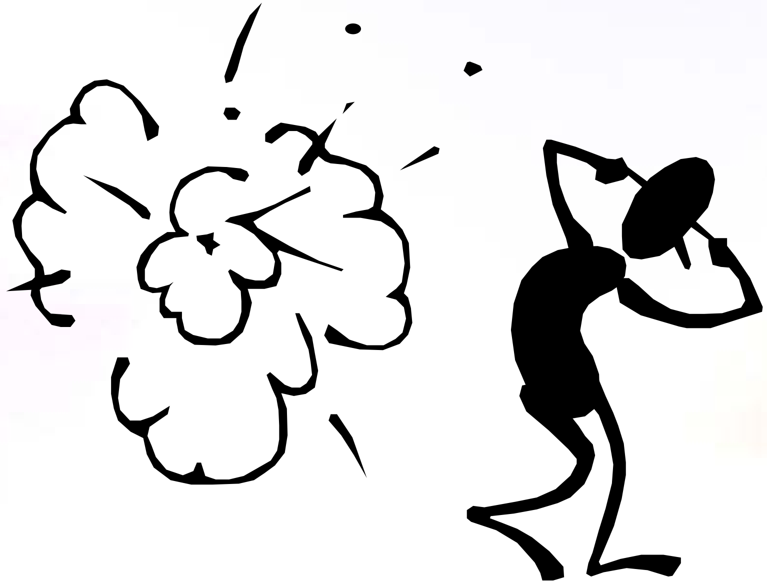
Risk-Based



- Enhances safety in some cases
- Reduces resources in some cases
- Better understanding in all cases
- Allows comparison and evaluation
- Prioritize resources to highest risk
- Risk-based decisions provide a more thorough treatment of quantity, class, distance, activity type, structures, environment

Why Was A Risk-Based Model Developed?

The U.S. currently uses Quantity-Distance (QD) criteria as the basis for siting explosives facilities. The QD method only considers explosives quantity, Hazard Division, and PES type to determine a safe separation distance. The SAFER model was developed to assess risks using additional considerations such as the type of activity at the potential explosion site (PES), the number of people at the exposed site (ES), and the building construction of the ES.

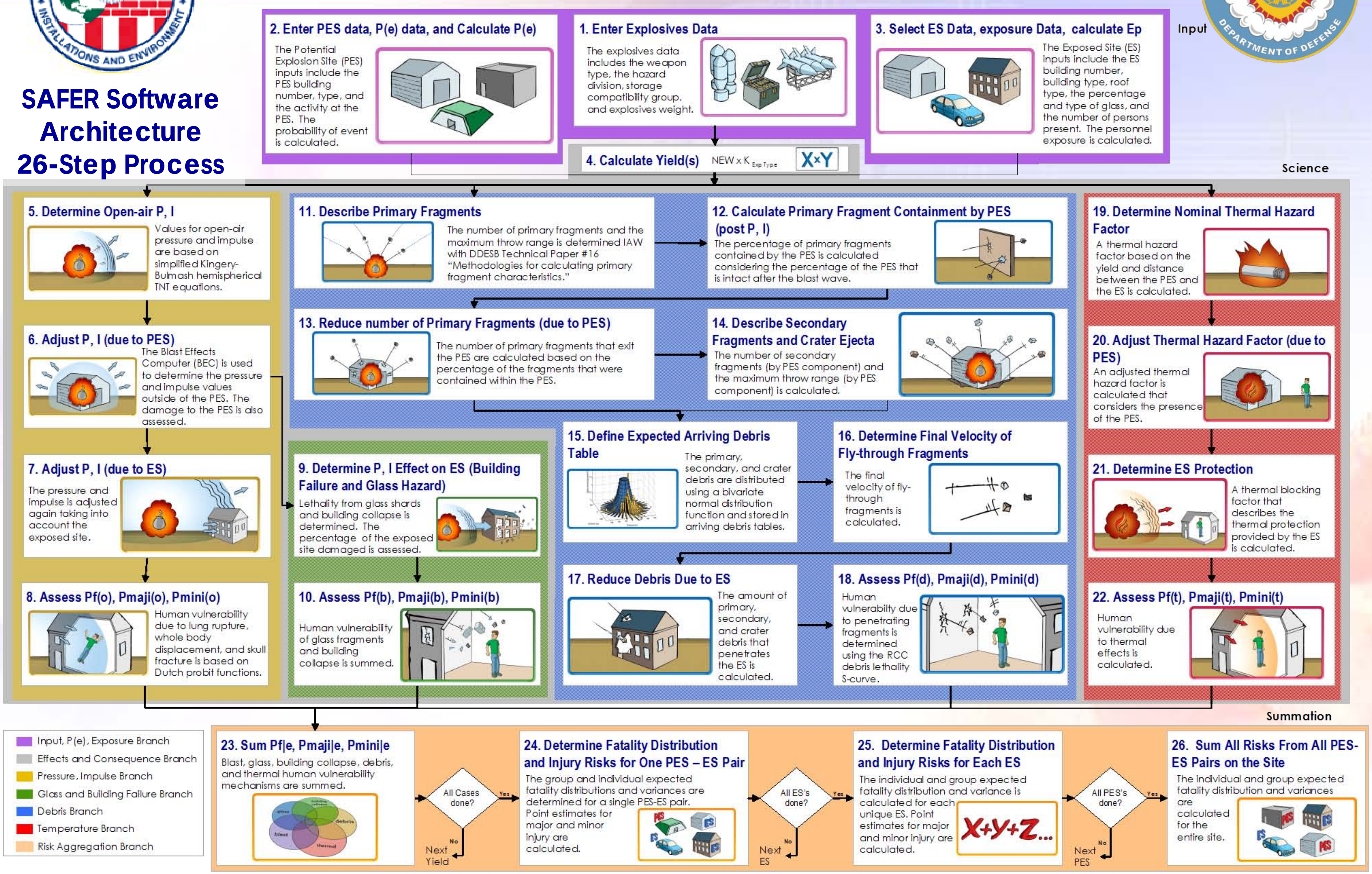


Background

1999 · 2000 · 2001 · 2002 · 2003 · 2004 · 2005 · 2006 · 2007 · 2008 · 2009

- Board approval of 3-year trial period – 12/9/99
- SAFER Version 1.0 distributed – May 2000
- SAFER V2.0 betas delivered to RBESCT
- DDESB extended trial period thru Dec ‘04
- • SAFER V2.0 delivery
  • DDESB Mtg. – Approval of BIC – Jun ‘02
- DDESB Approval of 6-year plan – Jan ‘03
- SAFER Version 2.1 release – Sep ‘03
- SAFER Version 3.0 beta – Nov ‘04
- DDESB extended trial until policy is incorporated in *DoD 6055.9-STD*
- SAFER Version 3.0 delivered to RBESCT
- SAFER V3.02 release – Mar ‘07
- DDESB approved policy (Chapter) for incorporation into *DoD 6055.9-STD*. Trial period terminated.
- Began work on SAFER Version 3. 1
- SAFER V3.1 release – Sep ‘09
- *DoD 6055.09-STD change 2* issued

Safety Assessment for Explosives Risk (SAFER) Tool



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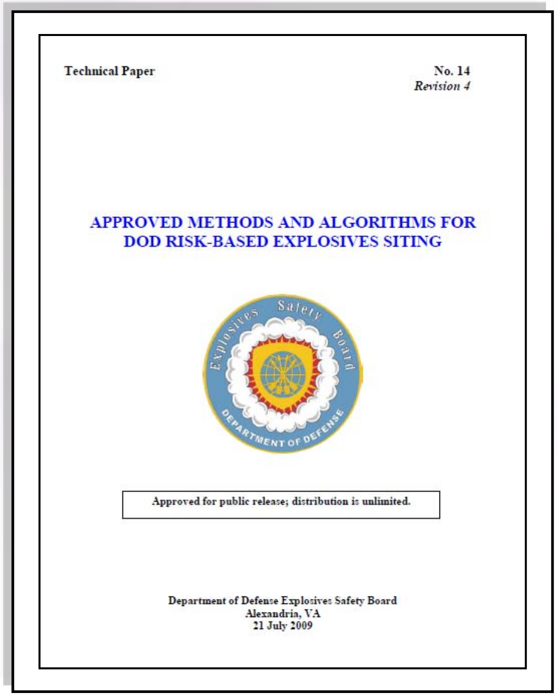
Technical Papers

The technical papers are posted on the DDESB website (http://www.ddesb.pentagon.mil/techpapers.html):

- Technical Paper #14
  - Technical Memoranda
- Technical Paper #19



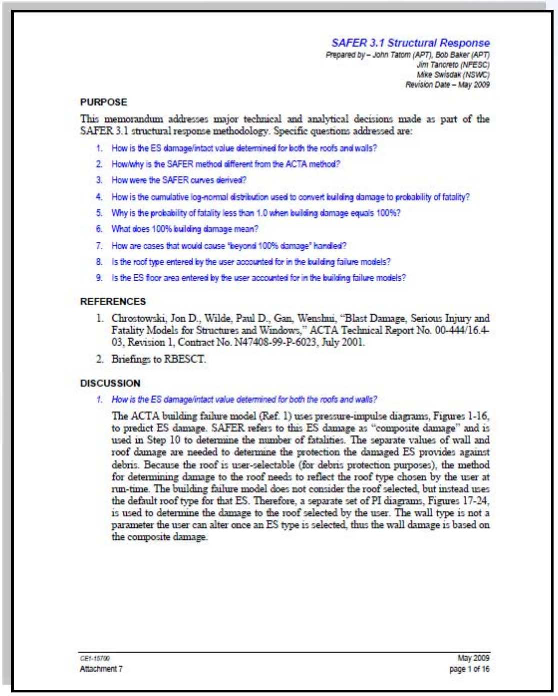
Technical Paper

No. 14
Revision 4

APPROVED METHODS AND ALGORITHMS FOR DOD RISK-BASED EXPLOSIVES SITING

Approved for public release; distribution is unlimited.

Department of Defense Explosives Safety Board
Alexandria, VA
21 July 2009



SAFER 3.1 Structural Response
Prepared by – John Tatom (APT), Bob Baker (APT)
Jim Tancreto (NFESC)
Mike Swisdak (NSWC)
Revision Date – May 2009

PURPOSE

This memorandum addresses major technical and analytical decisions made as part of the SAFER 3.1 structural response methodology. Specific questions addressed are:

1. How is the ES damage/intact value determined for both the roofs and walls?
2. How/why is the SAFER method different from the ACTA method?
3. How were the SAFER curves derived?
4. How is the cumulative log-normal distribution used to convert building damage to probability of fatality?
5. Why is the probability of fatality less than 1.0 when building damage equals 100%?
6. What does 100% building damage mean?
7. How are cases that would cause "beyond 100% damage" handled?
8. Is the roof type entered by the user accounted for in the building failure models?
9. Is the ES floor area entered by the user accounted for in the building failure models?

REFERENCES

1. Chrostowski, Jon D., Wilde, Paul D., Gan, Wenshui, "Blast Damage, Serious Injury and Fatality Models for Structures and Windows," ACTA Technical Report No. 00-444/16.4-03, Revision 1, Contract No. N47408-99-P-6023, July 2001.
2. Briefings to RBESCT.

DISCUSSION

1. *How is the ES damage/intact value determined for both the roofs and walls?*

   The ACTA building failure model (Ref. 1) uses pressure-impulse diagrams, Figures 1-16, to predict ES damage. SAFER refers to this ES damage as "composite damage" and is used in Step 10 to determine the number of fatalities. The separate values of wall and roof damage are needed to determine the protection the damaged ES provides against debris. Because the roof is user-selectable (for debris protection purposes), the method for determining damage to the roof needs to reflect the roof type chosen by the user at run-time. The building failure model does not consider the roof selected, but instead uses the default roof type for that ES. Therefore, a separate set of PI diagrams, Figures 17-24, is used to determine the damage to the roof selected by the user. The wall type is not a parameter the user can alter once an ES type is selected, thus the wall damage is based on the composite damage.

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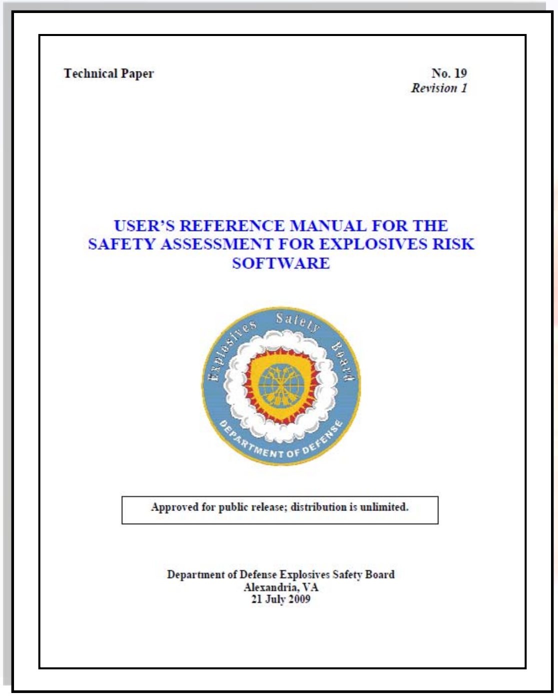


Technical Paper

No. 19
Revision 1

USER'S REFERENCE MANUAL FOR THE SAFETY ASSESSMENT FOR EXPLOSIVES RISK SOFTWARE

Approved for public release; distribution is unlimited.

Department of Defense Explosives Safety Board
Alexandria, VA
21 July 2009

Applications of SAFER

- Risk-Based Siting

  SAFER allows a user to perform risk-based site plans for situations that do not meet QD criteria. If the need for the siting satisfies the Services' requirement for a waiver/exemption and the risks are determined to be acceptable (i.e., below the DDESB risk acceptance criteria), a risk-based site plan may be approved by the DDESB.

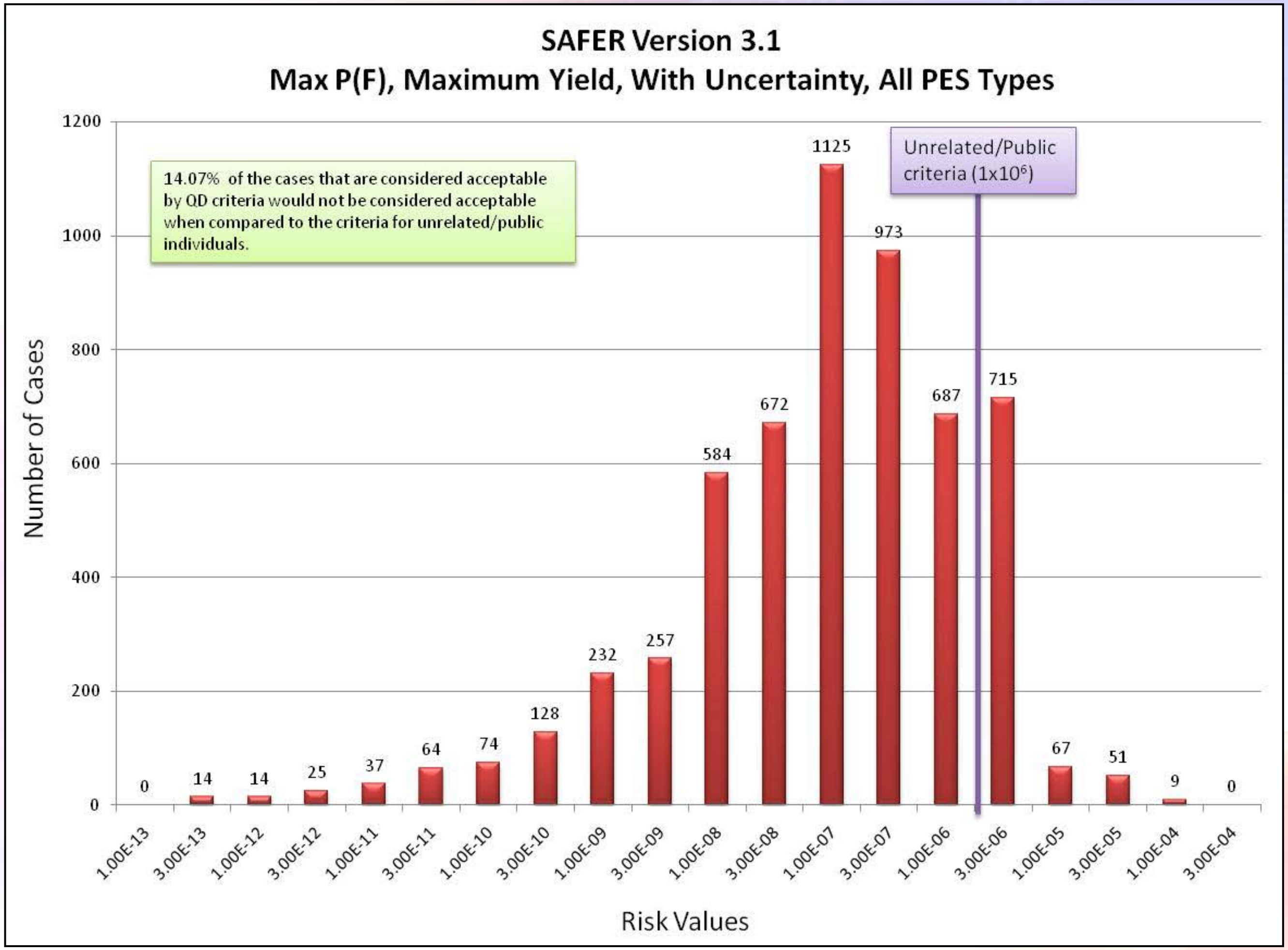
- Risk Management

  Using SAFER to identify mitigation measures is a very important application of the software tool. For example, the tool can assist in planning the location of a new building, the type of construction, and evaluating the risks associated with highly populated buildings that may be right outside the QD arc.

- Comparisons to Quantity-Distance Standards

  SAFER can also be used to assess the quantitative risk for scenarios that meet current QD Standards. Comparing a set of hypothetical cases that were considered acceptable by QD criteria it was determined that 14.07% of the cases would not be considered acceptable using the quantitative risk criterion for unrelated/public individuals.

Comparisons to Quantity Distance Criteria



- 5,728 hypothetical cases were defined which meet QD standards
- Hypothetical cases were entered into SAFER Version 3.1
- 14.07% of the cases that were considered acceptable by QD criteria were not acceptable per the approved quantitative risk criterion for unrelated/public individuals

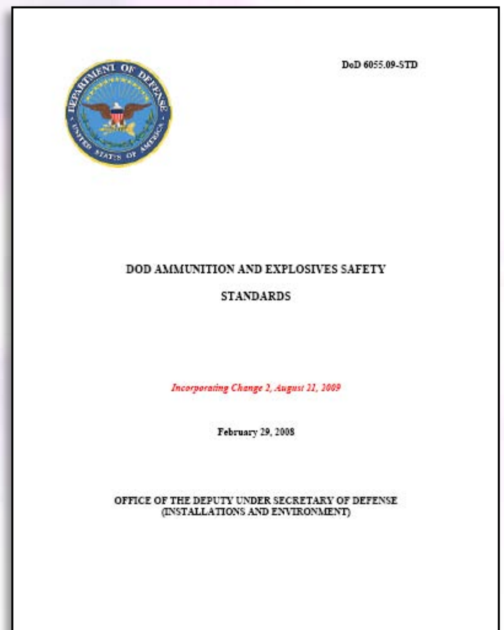
Current and Future Approaches for Communicating the Benefits

The RBESCT recognizes the importance of educating audiences of various backgrounds on the applications and the benefits of using the risk-based approach and the SAFER software and is making significant efforts to accomplish this goal.

- **Currently a training class is offered on SAFER.**
- **Future and current efforts are focused on development of:**
  - a step-by-step guide,
  - a workbook containing SAFER problems and solutions,
  - a Frequently Asked Questions (FAQs) document,
  - an informational video designed to familiarize the DoD explosives safety community with the SAFER risk-based approach to siting explosives facilities, and
  - a webpage for the DDESB website (http://www.ddesb.pentagon.mil) to provide the explosives safety community with background information on the RBESCT, the DDESB risk-based approach for siting, and the technical bases for SAFER.

DDESB Guidance on Risk-Based Siting

From *DoD 6055.09-STD DOD Ammunition and Explosives Safety Standards, Change 2, 21 August 2009*:


DoD 6055.09-STD

DOD AMMUNITION AND EXPLOSIVES SAFETY

STANDARDS

Incorporating Change 2, August 21, 2009

February 29, 2008

OFFICE OF THE DEPUTY UNDER SECRETARY OF DEFENSE
(INSTALLATIONS AND ENVIRONMENT)

CHAPTER 9 “QUANTITY-DISTANCE AND SITING” CHANGE

Addition of:

C9.1.2. If QD requirements of this Chapter cannot be met, risk-based siting may be used in accordance with conditions and criteria in Chapter 17.

CHAPTER 17 “RISK-BASED SITING” NEW CHAPTER

Highlights include:

C17.1. Scope. This chapter provides guidance and minimum requirements for quantitative risk-based siting. It provides the basis for quantifying the risks from a PES to personnel at each exposed ES (individual risk) and at all exposed ES (group risk) by performing a Quantitative Risk Assessment (QRA) when the QD criteria of this Standard cannot be met. Procedures are provided for preparing, submitting, and periodically reviewing risk-based site plans.

C17.2.1. Safety Assessment for Explosives Risk (SAFER©) is a DDESB approved software code (tool) for conducting risk-based explosives safety siting (DDESB TP 19 “User’s Reference Manual for the Safety Assessment for Explosives Risk Software,” reference (XX)). A detailed description of the approved risk and analysis approach and methodology (model) implemented in SAFER© is given in DDESB TP 14, Revision 3 “Approved Methods and Algorithms for DoD Risk-Based Explosives Siting,” reference (XX).

How does the Risk-Based Method Improve Explosives Safety?

- Risk-based methods can:
  - Quantify the risks that are being accepted,
  - Identify high risk situations and compare with alternatives,
  - Be used to prioritize resources to address the higher risks, and
  - Be used as a tool to evaluate future siting options, facility locations, dynamic field operations (e.g., port loading/unloading situations, airfields, camps, etc.).
- Risk-based assessments provide a more thorough treatment of quantity, class, distance, activity type, structures, and environment.

A Look Ahead to Future Versions of SAFER

Many tasks remain to be done:

- Revisit group risk
- Revisit uncertainty
- Revisit public traffic route (moving/stationary vehicle exposed sites)
- Continue Science Panel support
  - PES barricades
  - Improve ISO container modeling
  - Improve ES response models
  - Improve debris modeling
  - SAFER 3.1 flags
- Develop additional assessments
  - ✔ Major and minor injuries
  - Building damage (ESs)
  - Method to evaluate transients (people in the open)
  - "Other assets" (other exposures that QD protects)
- Integrate SAFER with automated site planning software

Related Papers/Presentations

- Session 15, Wednesday, July 14th, 10:20 a.m. – noon:
  - ISO-3: Program Description and Test Results (Jesse Davis, APT)
  - SciPan 4: Program Description and Test Results (Robert Conway, NAVFAC ESC)
  - SPIDER 2 Tests – Response of Typical Wall Panels to Debris and Fragment Impact (Dr. Michelle Crull, USACE)
  - Project ESKIMORE – An Update with Emphasis on a Proposed ECM Testing Program (Lea Ann Cotton, DDESB)
- Session 23, Thursday, July 15th, 8:10 a.m. – 9:50 a.m.:
  - The Future of SAFER Science and Integration of SAFER with ESS (Robert Conway, NAVFAC ESC)
- Session 26, Thursday, July 15th, 10:20 a.m. – noon:
  - Continued Study of the SAFER/SciPan Mass Bin Concept (John Tatom, APT)
  - ISO Container Source Function Development for the Klotz Group Engineering Tool (John Tatom, APT)

Summary

- The DDESB and Services have been supporting the development and implementation of an explosives risk-based model since 1997.
- *DoD 6055.09-STD, version 2, 21 August 2009* includes changes to allow explosives risk-based siting.
- Methods to communicate the use and benefits of SAFER are being defined.
- Future improvements have been identified.
- Questions?